PROCESS OPTIMIZATION

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Contents

Summary

Process optimization of an MSF plant is described based on technical criteria, namely, maximization of either the production rate or PR. An iterative program logic is developed incorporating TDM. An operating envelope for partial load operation is calculated.

1. Setpoint Variables

Any process optimization is based on certain criteria or objective functions. In seawater desalination, which uses a thermal process such as multistage flash (MSF) the following are some of the criteria.

(a) Minimum energy consumption: in other words, a high performance ratio (PR).
(b) Stable operation: reasonable brine levels in all the flash stages so that no flooding or vapor blowthrough occurs.
(c) Low fouling rates: this would limit the top brine temperature (TBT) and tube-side velocities.
(d) Low consumption of chemicals needed to treat the brine to minimize scaling and foaming.

In the process constraints part of Section 8 (See: Steady State Simulation), the effect of different operating variables on plant performance has been discussed in sufficient detail. As far as process optimization with respect to the first two criteria is concerned, i.e. maximum PR and stable operation, the important operation or setpoint variables are the TBT, brine recycle flow rate, and cooling seawater inlet temperature in the heat rejection section.

2. Technical Criteria for Optimization

In regions where the sea is the only viable source of fresh water, desalinated distilled

water for drinking purposes is offered at a subsidized price. In such a situation, the practical objective for optimization is as follows.

(a) In the summer, the demand for fresh water increases. At this time of year, the aim is to produce as much distillate as possible without concern for process efficiency. Hence, the objective is to maximize the distillate production rate regardless of the performance ratio.
(b) In another situation, the production rate is limited due to constraints on storage capacity. Here, the objective is to maximize the performance ratio at a fixed target production rate.

In the cases outlined above, the availability of the required steam supply is assumed.

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Bibliography and Suggestions for further Study

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Biographical Sketch

Asghar Husain received Master of Science degree in Applied Chemistry from the Osmania University, Hyderabad – India in 1948, Bachelor of Chemical of Engineering from the University of Michigan – U.S.A. in 1950 and Doctor of Science from the University of Indonesia in 1958 on submission of a thesis on batchwise distillation. This work has been abridged in Chemical Engineers Handbook by Perry in 4th to 6th edition, a McGraw Hill publication.

He taught at the Technical Faculty of the University of Indonesia at Bandung (1952 -1959) and at the Delhi Polytechnic, Delhi University (1959 – 1961). Then he joined as the Research Scientist in the Regional Research Laboratory (now known as IICT) in his hometown Hyderabad – India, a constituent of the Council of Scientific and Industrial Research (CSIR – Delhi).

He retired from the CSIR in 1984 with the title of Distinguished Scientist. The he served as the Professor of Chemical Engineering at Al Fatah University, Tripoli – Libya (1984-1988). Since 1991, he is associated with ICWES at Abu Dhabi, U.A.E.

He is the Author/co-Author of books on "Optimization Techniques for Chemical Engineers (Mac Millan publication), Modeling and Simulation of Chemical Plants (John Wiley publication). He also edited a book on Integrated Power and Desalination Plants (EOLSS Publishers, Oxford). He guided four Ph.D. thesis, two in the discipline of Chemical Engineering and two on modeling and simulation.